JEVONS' "THEORY OF POLITICAL ECONOMY."

None of the various filial services which Professor H. S. Jevons has performed in the way of rounding out and making more accessible his father's work will be received more gratefully by economists than the new edition of his most important book on economics.[1] Except for a few corrections and explanatory notes the body of the book is a reprint of the third edition, which has been out of print for some years, but some important new matter is given in the appendices. The promised extension of the bibliography of mathematical economics does not carry it beyond the year (1879) to which it had been brought in the third edition by Mrs. Jevons. Some new titles have been added, but the list as it stands is less complete than that part of the bibliography in Fisher's edition of Cournot which covers the same period. There are included, however, some interesting and previously unprinted notes by W. S. Jevons on a few of the writings of his predecessors and contemporaries.

It happens that it was just fifty years ago that Jevons, then twenty-seven years old, sent to the British Association meeting at Cambridge a short paper entitled, "Notice of a General Mathematical Theory of Economy." This was accompanied by another paper on "The Study of Periodic Commercial Fluctuations." Jevons' innovations in theory do not seem to have attracted much attention at the time of this, their first public presentation. He wrote to his brother that he was informed by the secretary that both papers "were read before the F Section, and the second [the statistical study] was approved of."[2] Jevons had become interested in political economy in the course of the extensive reading which filled most of his spare hours during the years from 1854 to 1859, while he was serving as Assayer of the Mint at Sydney, Australia. His conviction, then formed, that the field of "social science" had been unsatisfactorily tilled by previous writers and that it was a field in which he might hope to accomplish work of

[1] *The Theory of Political Economy,* by W. Stanley Jevons, *with Notes and an Extension of the Bibliography of Mathematical Economic writings* by H. Stanley Jevons. (Fourth edition. London: Macmillan and Company, Ltd. 1911. pp. lxiv, 339.)

[2] *Letters and Journals of W. Stanley Jevons,* Edited by his wife, p. 169.

importance, were among the reasons which led him to resign a fairly lucrative position and to return to England and an uncertain future. During the four years immediately following, Jevons completed his work for the B. A. and M. A. degrees at University College, London, where political economy continued to claim a considerable share of his attention. Two letters written to his brother in 1860 are worth quoting:[3]

During the last session I have worked a good deal at political economy; in the last few months I have fortunately struck out what I have no doubt is *the true Theory of Economy,* so thoroughgoing and consistent, that I cannot now read other books on the subject without indignation. While the theory is entirely mathematical in principle, I show, at the same time, how the data of calculation are so complicated as to be for the present hopeless. Nevertheless, I obtain from the mathematical principles all the chief laws at which political economists have previously arrived, only arranged in a series of definitions, axioms, and theories almost as rigorous and connected as if they were so many geometrical problems. One of the most important axioms is, that as the quantity of any commodity, for instance, plain food, which a man has to consume, increases, so the utility or benefit derived from the last portion used decreases in degree. The decrease of enjoyment between the beginning and end of the meal may be taken as an example. And I assume that on an average, the *ratio of utility* is some continuous mathematical function of the quantity of commodity. This law of utility has, in fact, always been assumed by political economists under the more complex form and name of the Law of Supply and Demand. But once fairly stated in its simple form, it opens up the whole of the subject. Most of the conclusions are, of course, the old ones stated in a consistent form; but my definition of capital and law of the interest of capital are, as far as I have seen, quite new.

. . . . I expect every success from my theory of political economy, which seems to develop itself with that facility which is a proof of its soundness. It assumes the form of a complicated mathematical problem, from which all the common laws with due limitations flow. Independently, however, of the mathematical form, it has led me to a new view of the action of *capital,* which affords a determining principle for *interest,* profits of trade, wages; and I now perceive how the want of knowledge of this determining principle throws the more complicated discussions of economists into confusion. The common law is that demand and supply of labour and capital determine the division between wages and profits. But I shall show that the whole capital employed can only be paid for at the same rate as the *last portion* added; hence it is the increase of produce or advantage, which this last addition gives, that determines the interest of the whole.

[3] *Letters and Journals,* pp. 151, 155.

These letters are significant, not so much because they have some bearing upon the more or less futile questions relative to Jevons' priority in the formulation of certain theories or the use of a particular method, as because they foreshadow so completely the tenets of the *Theory of Political Economy* of 1871. The book contains very little of importance beyond the matters mentioned in the letters of 1860. The printed abstract of the British Association paper of 1862,[4] in fourteen separate propositions, makes clearer the hedonistic basis of the new theory, explains the nature of the proposed mathematical equations, states the new definition of capital, and adds a tentative theory of wages. During the next few years Jevons gave his spare time to various studies in statistics and in logic and to his book on *The Coal Question.* When, in 1866, his paper on "A General Mathematical Theory of Political Economy" was first published *in extenso*,[5] it had received no revision. Logical studies, including some preliminary work on his *Principles of Science* continued to absorb his attention until the winter of 1870-71, when, Mrs. Jevons tells us,[6] "he returned with renewed interest to political economy and devoted himself entirely to the writing of *The Theory of Political Economy.* This work was of such absorbing interest to him that he made rapid progress with it." Some correspondence with Fleeming Jenkin relative to the use of the mathematical method in economics and the publication, in 1870, of Jenkin's "Graphic Representation of the Laws of Supply and Demand" in Grant's *Recess Studies* seem to have led Jevons to hasten this completer presentation of his own theories.[7]

Despite Jevons' growing reputation, the book was slow to make a place for itself. In 1874 Jevons wrote to M. d'Aulnis de Bourouill of the University of Leyden, "What I have written on the subject of mathematical economics has received little or no attention in England, and by those who have noticed it the theory has been generally rejected, or even ridiculed."[8] The "Saturday Review" had printed a review of the *Theory* by Cairnes, who did not let his confessed inability to understand much of the argument pre-

[4] *Report of the British Association for the Advancement of Science,* 1862, Notices and Abstracts, p. 158.

[5] *Journal of the Statistical Society,* vol. XXIX, p. 283. Reprinted as Appendix III in the present edition of the *Theory,* pp. 303-314.

[6] *Letters and Journals,* p. 251.

[7] H. S. Jevons' preface to the present edition of the *Theory,* p. lvii.

[8] *Letters and Journals,* p. 309.

vent him from handling it severely. Marshall had contributed to the "Academy" an able and discriminating review, which, although fair, was in no manner enthusiastic. The only English writer of importance who definitely espoused the cause of the mathematical method in general and Jevons' theories in particular was G. H. Darwin, who, in reviewing Cairnes' *Leading Principles* in the "Fortnightly Review" in 1875 defended Jevons' *Theory* against Cairnes's criticisms. It seems, however, that from the first the book had attracted somewhat more attention on the Continent than in England. Appreciative letters from such men as Walras, Bodio, and d'Aulnis de Bourouill and the ensuing correspondence with them must have done much to support Jevons' confidence in the soundness and importance of his own work and to quicken his desire to extend his analysis to other parts of the field of economic theory. Even his discovery that he was not the only one nor even the first in the field—that the very fundamentals of his theory had been anticipated in the forgotten writings of Gossen and Dupuit; that Walras, working independently, but almost contemporaneously with himself, had utilized methods and reached conclusions which were in many respects like his own; that Cournot had applied the mathematical method to a somewhat different class of problems with unequaled power and fluency—whetted rather than dulled his enthusiasm. Whatever disappointment he may have felt that some honor of priority was taken from him was more than balanced by the satisfaction that his theories rested upon so broad a basis of authority.

It was not long, however, before the *Theory* began to gain a more serious consideration in England than it had received at first. Jevons' standing as a logician of the first rank had been firmly established by the publication of *The Principles of Science*, and his continued output of brilliant studies on a wide variety of topics reached an appreciative and growing audience. In short, he had become a man to be reckoned with. The revolt against the political economy of the orthodox line, headed by Thornton, and continued by Cliffe Leslie and Ingram led some few persons, at least, to look for a new economic gospel. And the growing influence of Marshall's teaching at Cambridge was not without its effect. In 1875 Jevons wrote to Walras:[9]

[9] *Letters and Journals*, p. 332. In 1881 he wrote to the same correspondent, "I am glad to say I think the mathematical view of economics is making much progress in England, and is fully recognized by those competent to judge." *Ibid.*, p. 431.

I think that a considerable change of opinion is taking place in England. Various correspondents express their acquiescence, and some of the professors are beginning to bring the theory before their students. When I was in Cambridge two months ago I found that the subject was much better understood there than I had supposed, and I have little doubt about its gaining ground ultimately. . . . . I have no doubt whatever about the ultimate success of our efforts, but it will take some fighting; the disciples of J. S. Mill being bitterly opposed to any innovation upon his doctrine.

The second edition of the *Theory* (the last edition during Jevons' lifetime) appeared in 1879. The most important additions besides the bibliography of mathematical economics and the lengthy and interesting preface, are the discussions of the "dimensions of economic quantities." Here Jevons illustrates to perfection his extraordinary power of raising new questions of the utmost significance, without satisfactorily solving them. In some respects, one is forced to feel, his treatment of the "dimensions of economic quantities" is perfunctory and superfluous, while in other respects it is suggestive but tantalizingly incomplete and not altogether accurate.[10] But for the most part the second edition follows closely the lines of the first, and the first is little more than a working-out of the theses announced in 1862 and foreshadowed in the letters of 1860.

These facts, fairly well known for the most part, in the history of a book now become a classic, suggest in themselves the strength and the limitation of the work. In the preface to the second edition Jevons stated that the book "was never put forward as containing a systematic view of economics. It treats only of the theory and is but an elementary sketch of elementary principles. The working-out of a complete system based on these lines must be a matter of time and labor, and I know not when, if ever, I shall be able to attempt it."[11] Even more accurate is his description of the work as "a bare and imperfect outline of some of the more important theorems of political economy.[12] In fact, the book does not furnish even the skeleton of a system of economics. It contains only the uneven results of Jevons' attempts to expand and correlate his brilliant suggestions of 1862. Despite his continued in-

[10] This matter has been carefully discussed by Mr. P. H. Wicksteed, in the *Quarterly Journal of Economics,* vol. III, pp. 297-314.

[11] Fourth edition, p. xliii.

[12] Jevons to d'Aulnis de Bourouill, *Letters and Journals,* p. 309.

terest in these doctrines, the many and varied other interests of the author and his fertile originality kept his enthusiasm constantly centered on new intellectual problems. The *Theory* as it stands was written under the pressure of a sense of unfulfilled duty to himself and to his own reputation. Jevons' intellectual independence was too rugged and his antipathy to the school of Mill too deep to permit him to fit his own theories loosely into the general body of economic doctrine by a process of easy eclecticism. Not that he did not consciously accept and utilize certain established economic doctrines, such as the theory of land rent, but rather that all such had to be wrought over in his own thinking and thoroughly amalgamated with his own theoretical departures. The book, then, is not inconsistent, but rather, as was suggested, uneven and unsystematic. At one point we find, for example, such marks of staleness as tedious mathematical elaborations of truisms in the theory of exchange; at another point a brilliant but uncrystallized theory of interest. The first four chapters are, in general, more completely elaborated than are the remaining four. No one realized these deficiencies more clearly than Jevons himself. It was his hope to complete a large systematic treatise on political economy, which should embody his own views but which should be non-mathematical and in other ways less technical than his *Theory*. The disappointing fragments of the *Principles of Economics* do not enable one to say with any confidence that the project, if completed, would have been successful.[13]

The *Theory of Political Economy* is one of those books which are more widely quoted than read. There are indications, moreover, that the preface and the first three chapters are somewhat better known than the balance of the book. It is unfortunate for both Jevons' reputation and his influence that such should be the case, for the last three chapters contain the outlines of his theory of distribution, which, fragmentary as it is, is by no means a negligible contribution to economic science. Even the better known parts of the *Theory* are worth a reconsideration at this time, if for no other reason than that new currents of economic thought have brought Jevons' work into a somewhat different perspective than that in which it appeared to his contemporaries.

[13] The admirably lucid *Primer of Political Economy* does not throw any light upon the question of Jevons' power to weld his doctrines into an effective and rounded system of economic theory. Intended for elementary schools, it contains little theory, and what there is is mostly of a conventional sort.

Jevons was the first significant writer consciously to blend English utilitarianism with the theories of abstract economics. And no subsequent writer has more unqualifiedly and definitely accepted the hedonistic interpretation of economic motives. So extended is his discussion of the calculus of pleasure and pain and so explicit is his reliance upon it, that it might easily be inferred that the significance of his whole theory hinges upon the adequateness of the hedonistic psychology. But such, I think, is not the case. Mr. Wicksteed, himself a disciple of Jevons, has clearly shown in his *Common Sense of Political Economy*, that the notion of "marginal significance" retains as much validity when instincts and habits are counted among the forces governing men in their economic relations as when only "economic men," actuated solely by a reasoned pursuit of a maximum of pleasure, are postulated. Pareto, although many of his doctrines (especially those relating to the *maximum d'ophélimité*) are, like those of Walras, essentially hedonistic, is careful to point out that his general theory of "economic equilibrium" does not rest upon the postulate of utility (*ophélimité*).[14] Jevons' theories of exchange and distribution could be similarly divorced from their apparently hedonistic basis without substantial alteration of their essential features, and with a distinct gain in the flavor of actuality.

Jevons' elaborate exposition of the theory of utility was not, however, without purpose. The *Theory* embodies a protest against the economics of Ricardo and Mill. The chief count in the indictment was their neglect of the factor of utility in the "utility and scarcity" couplet, and it devolved upon Jevons to give this factor what he thought was its rightful position of primacy. But his interest in the analysis of utility went farther than establishing it as the psychological basis of the theory of catallactics. In Jevons' view economics and ethics were inseparably connected. "The object of economics," he says, "is to maximize happiness by purchasing pleasure, as it were, at the lowest cost of pain."[15] Jevons seems to have hoped that the principles of economics would be useful guides to individual as well as to social action. This would, of course, involve a curiously circular system, for his general economic principles were supposedly deduced only from assumptions as the

[14] *Manuel d'économie politique,* p. 169, note.

[15] *Theory,* p. 23. Compare the frequent assertions of the ethical purpose of economics in the *Primer.*

motives which do actually operate in economic intercourse. But Jevons' utilitarian ethics could be eliminated from his work even more easily than his hedonistic psychology. Whatever would have been the position of ethics in his completed system, the book as it stands is confessedly concerned only with "the mechanics of utility and self-interest."[16]

The most famous contribution of the *Theory* is the concept of the "final degree of utility." This concept is not precisely like the concept of "marginal utility," with which it has usually been identified. For practical purposes both concepts come to about the same thing, and such difference as there is may be attributed to the fact that the concept of "marginal utility" was not, in its origin, mathematically formulated.

The final degree of utility is, substantially, the quotient of marginal utility (conceived as the utility of the marginal increment) divided by the size of the marginal increment, where this increment is very small. More accurately, it is the *ratio* of the increase in total utility to the increase in the quantity of the commodity *at the margin.* "Final degree of utility" is not only the more precise notion but it has the further advantage of being conceptually independent of the nature of the unit (pounds, bushels, yards, etc.) in which the commodity in question is usually measured. This latter quality made possible its convenient use in Jevons' "equations of exchange."[17] But marginal utility is the less abstract concept, and is undoubtedly better adapted to popular exposition.

Jevons did not utilize the notion of "subjective value" in his theory of exchange, although he suggested that final degree of utility is synonymous with value in the sense of "intensity of desire or esteem for a thing." What Jevons, in common with other mathematical economists, primarily concerned himself with was the *ratio of exchange.* His fundamental theorem is that the ratio of exchange of two commodities is inversely proportional to their final

[16] *Theory,* p. 21.

[17] The theorem that a person tends to adjust his expenditures so that the "marginal utilities" of the various commodities consumed are equal is, of course, true only when it is stipulated that the marginal increment is conceived as the amount of a commodity that can be bought with a dollar or other small unit of money. When "final degrees of utility" are involved, the theorem holds true without qualification. "Marginal utility" is, for this reason, poorly adapted to the analysis of barter. "Final degree of utility" is the precise equivalent of Pareto's *ophélimité élémentaire* and of Walras' *rareté.*

degrees of utility. Final degree of utility is thus used, not as measuring value, but as determining a proportion.

The mathematical statement of this principle took the form of the well-known "equation of exchange," which remains Jevons' most substantial contribution to distinctly mathematical economics.[18] It cannot be said, however, that this equation has proved itself a useful tool in economic analysis. It assumes direct barter between a pair of traders. Professor Edgeworth has shown in his *Mathematical Psychics* that, given under these conditions only the functions which express the utility to each of the traders of the commodities to be (partly) exchanged, the ratio of exchange will be indeterminate. Either the quantities exchanged or the rate of exchange itself must be given to make the problem determinate. Jevons meets the difficulty by invoking the "law of indifference" (that there cannot be more than one price for any one article in the same market at the same time). This means, of course, that his traders are not to be considered as isolated, but as members of a general market. There are, however, substantial reasons for thinking that postulating the "law of indifference" is equivalent to assuming the existence of a general medium of exchange.[19] Jevons did not realize that he had implicitly made such an assumption. Like many other economists he seems to have considered purchase and sale and money prices as only the superficial aspects of barter and of direct "ratios of exchange." By thus neglecting to deal directly with the positive facts of the market, he forfeited something of scientific precision as well as some advantage in exposition.

When we pass from the bargains struck by pairs of traders to the larger problem of the determination of the ratios of exchange in the general market, the difficulties of Jevons' methods are multiplied. Jevons avoids rather than meets these difficulties by utilizing the concept of the "trading body," which "may be a single individual in one case; it may be the whole inhabitants of a continent in another; it may be the individuals of a trade diffused through a country in a third. England and North America will be trading bodies if we are considering the corn we receive from America in exchange for iron and other goods. . . . . The

[18] It is, for example, the only formula in the *Theory* mentioned by Pareto in his article *"Anwendungen der Mathematik auf Nationalökonomie,"* in the *Encyclopädie der mathematischen Wissenschaften.* The equation is identical with Walras' "equation of maximum satisfaction."

[19] *Cf.* Marshall, *Principles of Economics,* fifth ed., appendix F.

farmers of England are a trading body when they sell corn to the millers, and the millers both when they buy corn from the farmers and sell flour to the bakers."[20] The trading body, whatever its nature, is made to play the role of an individual trader. Thus, by the equation of exchange, the ratio at which English iron is exchanged for American wheat is the reciprocal of the ratio of the final degree of utility of iron to the final degree of utility of wheat, which latter ratio must be the same for both trading bodies. Jevons was too clear a thinker really to adopt the vague concept of "national (or group, or social) final degree of utility." But he thought that the economic laws representing the conduct of groups might be thought of as "fictitious averages" of the laws representing the conduct of the different individuals in the group.

The highly abstract and figurative nature of the concept of the "trading body," as applied to the whole group of dealers in a commodity, is indicated by the fact that if it were taken in any literal sense the market could not be supposed to be competitive. With all the millers and all the bakers in England conceived rigidly as a single pair of traders, the "law of indifference" could not be invoked, and the equation of exchange would not lead to a determinate ratio of exchange. Jevons' refusal to assume a general medium of exchange is primarily responsible for these difficulties. When the existence of money is taken into account Jevons' equation of exchange leads very naturally to the analysis of *supply and demand at a price.* In discussing Thornton's criticism of the "laws of supply and demand," Jevons for the moment slips into the vocabulary of the money economy: "Any change in the price of an article will be determined not with regard to the large numbers who might or might not buy it at other prices, but by the few who will or will not buy it according as a change is made close to the existing price.[21] Jevons fails to see the inconsistency of this now generally received principle of the significance of marginal traders with his own notion of the operations of a trading group as an average of the operations of its members, and its perfect consistency with the theory of market value for which he takes Mill to task.

Jevons' discussion of the relation of the costs of production of

[20] *Theory,* p. 88.

[21] *Theory,* p. 109. In the *Primer,* p. 100, he uses the very "equation of demand and supply" for which he criticises Mill in the *Theory,* p. 101.

commodities to their ratios of exchange is also based on the hypothesis of a barter economy, and is subject, in general, to the same limitations that obtain in his treatment of the relation of utilities to ratios of exchange. The ratio of exchange of two commodities is held to be directly proportional to the "degrees of productiveness of labor applied to their production." The "degree of productiveness of labor" is the ratio of product to the labor expended in producing it at the margin where the degree of disutility of labor is equal to the degree of utility of the product. Costs of production (in labor) are, of course, inversely proportional to the "degrees of productiveness."

In this manner Jevons develops new equations of exchange in which cost of production plays precisely the same rôle assigned to utility in his previous equations. His argument that the significant fact, however, is utility rather than cost of production, opened up a whole field of controversy which need not be surveyed here.[22] It may be noted, however, that Jevons' position on this question is completely disassociated from his general theory of exchange, and the reasons he gives for his attitude are extraneous to the general run of his analysis. Furthermore, in his brief for the dominance of utility he breaks with his resolution to use the term "ratio of exchange" instead of "value" wherever possible, and his argument seems to be somewhat dependent upon the dubious meaning of the latter word. Finally, it is obvious that his criticism of the "cost of production theory of value" had no bearing upon the prevalent form of that theory, which was simply a statement of admitted facts relative to long-period price tendencies under conditions of free competition.

The central point in Jevons' theory of distribution is his doctrine of interest. It is an indication of the comparative neglect of the latter portions of the *Theory* that only one writer,[23] so far as I know, has credited Jevons with the marginal productivity theory of interest. Not even the similarity of the diagram[24] which Jevons uses to illustrate his theory to those used in recent expositions of the marginal productivity theory seems to have been noticed. In fact, however, there is an important difference between

[22] So far as the validity of Jevons' own arguments is concerned, Marshall's criticism in his *Principles,* fifth ed., Appendix I, seems to me to be definitive.

[23] G. Cassel, *The Nature and Necessity of Interest,* pp. 52-55.

[24] *Theory,* p. 258.

Jevons' statement of the theory and its more recent formulation. Jevons did not utilize the principle of *diminishing productivity* in the way in which it has been more recently expounded. Considering the function of capital to be to extend the interval of time "between the moment when labor is exerted and its ultimate result or purpose accomplished,"[25] he defined capital as the "aggregate of those commodities which are required for sustaining laborers of any kind or class engaged in work."[26] Capital may be "invested in" factory buildings, machines, and other auxiliary instruments of production, but the "stock of capital" is the stock of sustenance. Consequently interest appears as created by a larger product, got when a given amount of labor is distributed through a longer period of time. Moreover, he assumed, without proof, that the product for the same amount of labor "varies as some continuous function of the time elapsing between the expenditure of the labor and the enjoyment of the result." It is to the period of the investment, then, rather than to the amount of the capital invested that he attributes diminishing productivity.

It should be remembered, however, that here, as in his theory of exchange, Jevons is endeavoring to dig below the surface of our money economy. His "investment of capital" is a social process, and not a matter of the expenditures of individual entrepreneurs. The modern form of the theorem of diminishing productivity rests upon the analysis of entrepeneurs' costs. By a somewhat generous interpretation Jevons' theory might be said to imply substantially the facts that are utilized in the modern form of doctrine.[27] On the whole, however, his theory bears a closer relation to Böhm-Bawerk's doctrine of the "technical superiority of present goods" than to the current marginal productivity theory.

Other features of Jevons' theory of distribution need less consideration. He accepts the orthodox theory of rent and propounds

[25] *Theory*, p. 228.

[26] *Theory*, p. 223.

[27] An attempt to show this agreement has been made by H. S. Jevons in Appendix I to the present edition of the *Theory*. A previously unpublished fragment on capital intended to form part of the unfinished *Principles of Economics* is printed as another appendix. Its most interesting innovations are the substitution of "capitalization" for "capital" and the implication that interest attaches only to free capital, fixed capital getting its reward in the form of rent or (as in the case of investments for a man's education) in wages. By "capitalization" Jevons means the amount of the capital multiplied by the period of investment.

a residual claimant theory of wages. He seems to have been led to this latter doctrine by his marginal productivity analysis. Using labor as the fixed, and capital as the variable, factor, wages naturally appeared as a surplus or residuum on the product of all but the final increment of capital. The possibility of treating capital as the fixed factor and labor as the variable seems to have escaped his notice.

Some general aspects of Jevons' use of the mathematical method remain to be considered. The book is probably the best known single brief for the use of that method. But the work itself is mathematical only in a superficial way. Except for its use of mathematical symbols it is, for the most part, mathematical only in the sense that any economic reasoning dealing with changing quantities and ratios is *ipso facto* mathematical. Cournot (to take the best exponent of the possibilities of the method) entrusted himself to his symbols, and by means of strictly mathematical processes reached some conclusions which were neither obviously implied in his premises nor likely to be easily discerned by the ordinary processes of non-mathematical reasoning. There is no question but that some of Jevons' fundamental concepts presented themselves to him as mathematical quantities. But his manipulation of these concepts is for the most part non-mathematical. Jevons was not an accomplished mathematician and he did not think easily in mathematical terms. In some places the awkwardness of his mathematical processes[28] indicates that he is giving a mathematical garb to results reached by non-mathematical reasoning. Such attempts as he makes to develop some of the mathematical possibilities of his concepts are fairly perfunctory. It should also be observed that his use of the differential calculus is more apparent than real. "Final degree of utility," for example, although conceived as a derivative is treated as an algebraic ratio. His equations are also consistently algebraic. There seems to be no reason for questioning Marshall's judgment that "the book would be improved if the mathematics were omitted, but the diagrams retained."[29]

It is difficult to estimate the amount of Jevons' influence, because it is impossible to disassociate it from that of Walras, Sax, Menger,

[28] *Cf.* especially pp. 127-134 of the present edition.

[29] *Academy,* vol. III, p. 132.

Böhm-Bawerk, Marshall, and others. In England the line of filiation runs clear only in the case of Professor Edgeworth, who has taken Jevons' work for the point of departure of some of his own brilliant developments of mathematical economics, and of Mr. Wicksteed, in whose work we find a rare degree of originality coupled with a faithful adherence to Jevons' general point of view and to some of his leading doctrines. In Italy, where a translation of the *Theory* appeared in 1875, Jevons wielded for some time a considerable influence, but in later years the influence of the Lausanne school seems to be dominant (so far as mathematical economics is concerned). In Germany, Scandinavia and Holland, individual writers such as Launhardt, Auspitz and Lieben, Wicksell, Cassel, and Pierson are to be counted among those who have followed Jevons at one point or another. In the United States, of course, Jevons' influence has been quite overshadowed by that of the Austrians.

It is clear, however, that although Jevons did not bring about the revolution in economic theory which he desired, the current body of economic doctrine is measurably different from what it would have been if Jevons had not written. His doctrines have been absorbed into the general structure of economic theory and reconciled with the political economy of the Ricardian line in a manner which we may suppose Jevons would have neither imagined nor wished. But the position of the *Theory* as one of the four or five great books of nineteenth century English political economy is secure. It retains in a surprising degree the quality of making a fresh and vivid appeal to the reader's interest. Its transparent intellectual honesty and the entire absence of scientific pose also commend it. If only by the dissent which it may compel, it still directs the attention of the thoughtful reader to the fundamental problems of economic theory.

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